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PROCESS FOR BLEACHING TEXTILES

Applicant: HOECHST AKTIENGESELLSCHAFT
D-65926 Frankfurt (DE)

Inventors

Hendrik Ahrens
Ostendstrasse 61
D-60314 Frankfurt am Main
(DE)

Gerhard Sauer
Rotebergstrasse 37
D-65779 Kelkheim (Taunus)
(DE)

Erwin Redling
Weiherstrasse 31
D-56348 Dahlheim (DE)

The present invention pertains to a process for bleaching raw textile materials with the help of organic peracids and hydrogen peroxide, comprising the following steps in the process:

- treating the raw textile material in an aqueous alkaline bleaching bath

- subsequent impregnation of the raw textile material and
- subsequent cold deposition or heating of the raw textile material, whereby this [process] is characterized by the feature that the bleaching bath contains a bleach activator.

During the bleaching of textiles, the raw textile material is bleached in order to prepare it for dyeing or for final finishing. In the past, it was usual to use bleaching agents such as hydrogen peroxide, sodium hypochlorite or sodium chlorite.

It has been found that halogeno-organic compounds are produced as a result of the use of hypochlorites in bleaching processes, and these can be injurious to health. This leads to the situation where this bleaching agent is being increasingly dispensed with.

Chlorine dioxide, which is injurious to health and which represents an odor problem, is formed during bleaching with sodium chlorite that is carried out in the acidic pH region. In addition, this bleaching agent can be used only in selected textile machines that consist of special materials.

As a result of these disadvantages, use is preferably made of hydrogen peroxide bleaching.

It can be seen from the review article "Aktivatoren und Stabilisatoren für die Peroxidbleiche" [Activators and Stabilizers for Peroxide Bleaching] by Dr. W. Ney in Textilpraxis International 1974, October and November, pages 1392 and 1565, that hydrogen peroxide is the most common bleaching agent today for all natural fibers of plant and animal origin.

In order to achieve a bleaching effect with hydrogen peroxide, it must first be activated. In addition, stabilization of the bleaching solution is necessary in order that losses of active oxygen may be as low as possible.

Activation with alkali is generally conventional and is the best known method. In the case of bleaching cellulose fibers, caustic soda is almost exclusively preferred for bleaching cotton, and soda [sodium carbonate] is almost exclusively preferred for bleaching bark fibers - especially linen. A disadvantage with the use of alkali is the sensitivity of animal fibers to alkalis.

Hydrogen peroxide can be activated using means other than alkali, e.g. via the chemical reaction of hydrogen peroxide to give organic and inorganic peracids.

The use of peracetic acid in textile bleaching is known from the publication by G. Rösch, Deutsche Textiltechnik 10 (1960), Number 4, pages 191-195. Peracetic acid is flammable. The concentrated solution, which has a pungent odor, is corrosive and causes burns on the skin. The biggest disadvantage of peracetic acid is its high explosiveness. If acetic anhydride is used for its manufacture, then, under unfavorable circumstances, diacetyl peroxide can be formed as a secondary product and this also tends to decompose spontaneously.

These characteristics might constitute the reason why peracetic acid has not enjoyed success, which had been expected, as a bleaching agent.

Apart from the aforementioned methods of activation, there are also series of chemical compounds that, as a result of the formation of peracids, can be considered as activators for hydrogen peroxide.

According to W. Ney, certain compounds, which possess a large number of reactive acyl groups in combination with a molecular weight that is as low as possible, have proven to be especially effective, e.g. tetraacetylethylenediamine (TAED) and tetraacetylglycoluril (TAGU).

The use of acetylated glycolurils, particularly TAGU, has become known from DE-OS-1 695 219 for, above all, the bleaching of fibers of all types.

EP-A-125 641 and US-A-4 544 503 disclose the use of salts of acyloxybenzenesulfonic acid (AOBS) as activators for the peroxide bleaching of fabrics and as auxiliary dyeing agents for dyeing acrylic fibers.

EP-A-442 549 mentions the use of phthalimidoperoxycarboxylic acids as bleaching agents for fabrics and hard surfaces.

In regard to the good results with the lower aliphatic percarboxylic acids, there is also the desire to use the percarboxylic acids as bleaching agents for bleaching textiles.

The task for the invention is to provide a process that permits the risk-free use of aliphatic percarboxylic acids, especially peracetic acid, as bleaching agents for bleaching textiles such that the process does not exhibit the disadvantages of the prior art, such as damage to the textile material that is to be bleached, and inadequate bleaching power.

The subject of the invention is a process for bleaching raw textile materials with the help of organic peracids and hydrogen peroxide, comprising the following steps in the process:

- treating the raw textile material in an aqueous alkaline bleaching bath
- subsequent impregnation of the raw textile material and
- subsequent cold deposition or heating of the raw textile material, whereby this [process] is characterized by the feature that the bleaching bath contains a bleach activator.

Suitable bleach activators are the amides of carboxylic acids, the esters of carboxylic acids and the salts of sulfonic acids. Use is preferably made of triacetylethanolamine (TAEA), tetraacetylethylenediamine (TAED), pentaacetylglucose (PAG), tetraacetylglycoluril (TAGU), 1,5-diacetyl-2,4-dioxohexahydrotriazine (DADHT), nonanoylbenzenesulfonate (NOBS), p-benzoyloxybenzenesulfonate in its Na salt form (BOBS) and resorcinol acetate-nonanoate.

Use is preferably made of the following as the textile materials: cellulose, especially non-pretreated natural cellulose such as hemp, linen, jute, cotton, regenerated cellulose fibers such as rayon staple, viscose acetate, rayon, animal-based fibers such as wool and silk as well as

synthetic fibers such as polyamide fiber materials, polyacrylonitrile fiber materials, or polyester fiber materials as well as fiber mixtures e.g. those comprising polyacrylonitrile and cotton or polyester and cotton.

The textile material that is to be treated can be present in forms corresponding to the various stages of its processing, such as e.g. the cellulose-containing material in the form of the loose material, flocks, combings, yarn, knitted material, woven material or mesh material.

The textile material is treated continuously or discontinuously in the aqueous bath. In addition to the designated bleach activators, hydrogen peroxide and optionally peroxide stabilizers, the aqueous bleaching bath contains detergents and wetting agents, additives such as defoaming agents and agents to improve dissolution, buffer systems such as phosphate salts and citric acid and basic salts such as sodium hydrogen carbonate, disodium carbonate and/or sodium hydroxide.

The pH value of the bleaching bath is in the range from 5 to 13 or, preferably, 7 to 9. The molar ratio of the hydrogen peroxide to the bleach activator depends on the molar ratio of the hydrogen peroxide to the active carbonyl groups in the bleach activator, where hydrogen peroxide is used in an excess molar amount.

A molar ratio of hydrogen peroxide to the bleach activator of 2-10:1 or, preferably, 2.2-3:1 is found [to be best] for bleach activators with two active carbonyl groups such as TAED and PAG. The molar ratio of hydrogen peroxide to the bleach activator amounts to 1.0-5:1 or, preferably, 1.1-1.5:1 for bleach activators with one active carbonyl group such as BOBS, NOBS and iso-NOBS.

In the case of using solid bleach activators, the bleaching bath is usually prepared in a bath preparation container by mixing together the individual components and transferring them to the bleaching apparatus or the impregnation vat after an adequate time of dissolution or reaction.

The time for dissolution or reaction generally amounts to one h or, preferably, 20 to 30 min.

In the case of using liquid bleach activators, such as TAEA, the bleaching bath can be prepared in the bath preparation container in the manner that was described above, or it can be metered directly via a metering device, together with the remaining liquid component of the bleaching bath, directly to the bleaching apparatus or to the impregnation vat. The textile material is treated with the bleaching bath solution in the bleaching apparatus or the impregnation vat. Treatment with the bleaching bath solution usually takes place using a continuous process by means of impregnation, i.e. wetting and soaking the raw textile material with the bleaching bath solution. After impregnation, the raw material is either deposited over a period of 0.5 to 24 h in the cold state, usually at room temperature, or heated with steam in

atmospheric evaporators to temperatures of 95 to 102°C. The dwell times at this temperature amount to [from] 1 min to 2 h. A further bleaching process, e.g. alkaline peroxide bleaching, usually follows this bleaching with bleach activators. It has been found that good degrees of whiteness of the textile material are obtained as a result of the combination of activator-bleaching with alkaline peroxide bleaching. After bleaching, the textile material is washed or forwarded to an additional pretreatment stage such as impregnation.

The following examples are intended to elucidate the process in accordance with the invention.

Example 1:

Bleaching on a Babcock broad bleaching apparatus 100% cotton, after enzymatic de-sizing

a) Activated peroxide bleaching (formerly chlorine)

3.4 g/kg of TAED

5.8 g/kg of H_2O_2 (35%)

6.4 g/kg of calcined soda

3 g/L of Lastabil TGS® (peroxide stabilizer)

2 g/L of Hostapal FA® (detergent and wetting agent)

0.1 g/L of RS defoaming agent

bath preparation in the bath preparation container; usually 500-2000 L; cold impregnation; 30 min at 100°C in a U-box (depository); then 3 washes with demineralized water at 90-60-40°C.

b) Alkaline peroxide bleaching:

45 g/L of H_2O_2 (35%)

12 g/L of NaOH

6 g/L of Lastabil TGS® (peroxide stabilizer)

3 g/L of Hostapal FA® (detergent and wetting agent)

cold impregnation; 15 min at 100°C in the "Kombi" [combination] evaporator; material conveyance in bound form and deposition on roller bed; then 3 washes at 90-90-60°C; drying in cylinder dryer.

Material is absolutely free from kinks; degree of whiteness corresponds to full whiteness for optical brightening.

Example 2:

1-step cold bleaching in accordance with the "cold pad-batch" process; impregnation of cotton knitted material with

10 g/L of TAEA
10 g/L of H_2O_2 (35%)
10.6 g/L of calcined soda
10 g/L of Lastabil TGS®
4 g/L of Hostapal FA®.
Cold deposition for 2 h and washing out. The material is free from kinks; the degree of whiteness corresponds to a pigment-white and the material excels by virtue of a pleasant soft feel since cotton waxes remain behind on the material.

Example 3:

Two-step bleaching process on de-sized cotton woven material or cotton knitted material; impregnation in TAED bleaching bath solution as under 1a); steam material for 15 min at 100°C in the "Kombi" [combination] evaporator; then wash. The material is again impregnated with bleaching bath solution as described under 1b); steamed for 15 min at 100°C and washed out. The material corresponds to the standard of Example 1.

Claims

1. Process for bleaching raw textile materials with the help of organic peracids and hydrogen peroxide, comprising the following steps in the process:

- treating the raw textile material in an aqueous alkaline bleaching bath
- subsequent impregnation of the raw textile material and
- subsequent cold deposition or heating of the raw textile material, whereby this [process] is characterized by the feature that the bleaching bath contains a bleach activator.

2. Process in accordance with Claim 1, characterized by the feature that the treatment of the raw textile material takes place in a bleaching apparatus or an impregnation vat.

3. Process in accordance with Claim 1, characterized by the feature that the molar ratio of hydrogen peroxide to the bleach activator in the bleaching bath amounts to 1.0-5:1 or, preferably, 1.1-1.5:1, based on the number of active carbonyl groups in the bleach activator.

4. Process in accordance with Claim 3, characterized by the feature that alkaline peroxide bleaching takes place after bleaching with bleach activators.

5. Process in accordance with Claim 1, characterized by the feature that the pH value of the bleaching bath is in the range from 5 to 13 or, preferably, 7 to 9.

6. Process in accordance with Claim 1, characterized by the feature that the raw textile material is deposited over a period of 0.5 to 24 h in the cold state.

7. Process in accordance with Claim 1, characterized by the feature that the raw textile material is heated to a temperature of 95 to 102°C.